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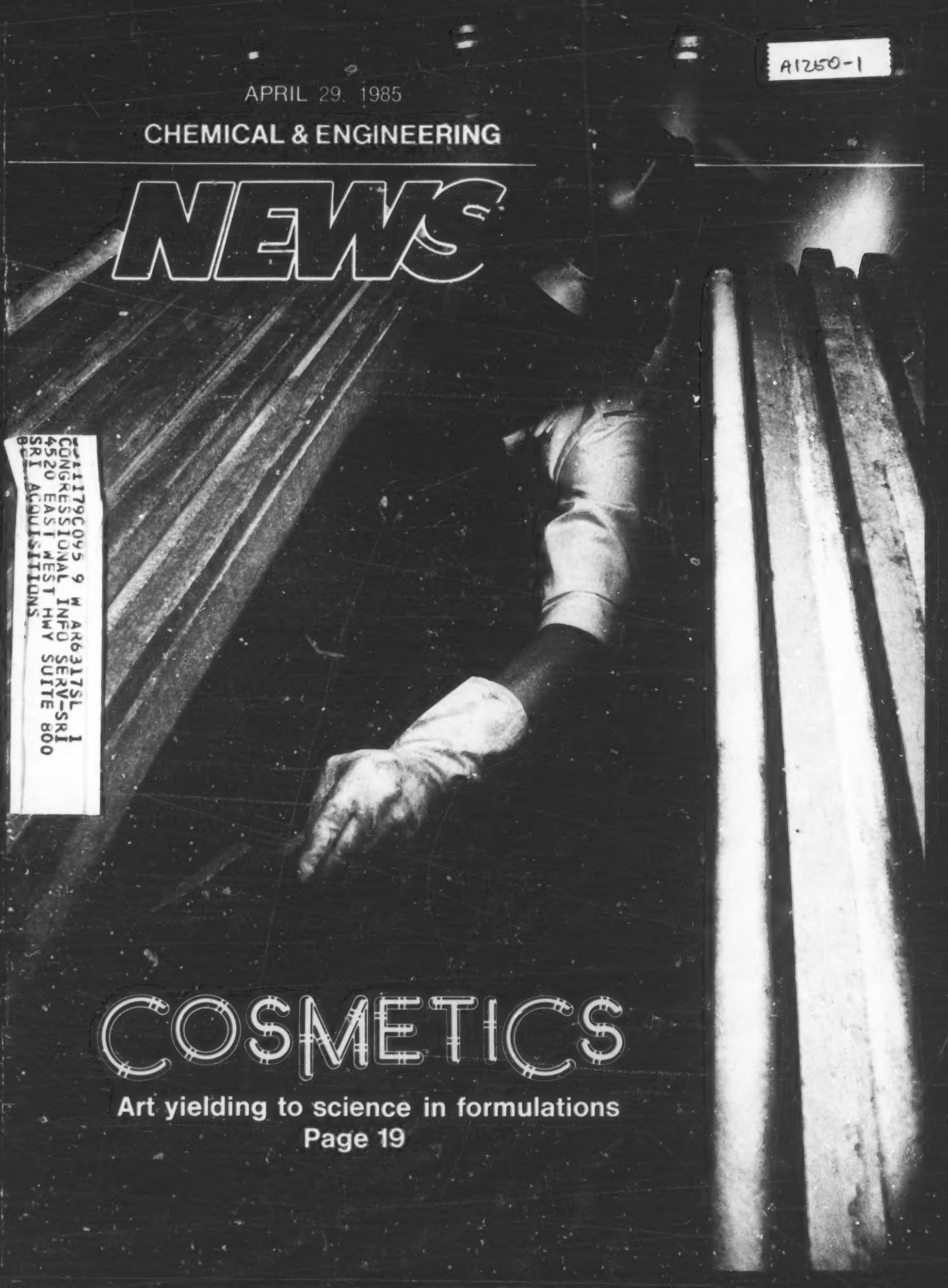
APRIL 29, 1985

CHEMICAL & ENGINEERING

NEWS



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COSMETICS

Art yielding to science in formulations

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CHEMICAL & ENGINEERING NEWS

Volume 63, Number 17
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APRIL 29, 1985

News of the Week

■ **Post-Bhopal safety concerns prompt new Center for Chemical Plant Safety.** **Page 6**

■ **Union Carbide stands up to Indian criticism of settlement for Bhopal victims.** **Page 7**

■ **Chemical earnings apparently were down at least 26% in first quarter from year ago.** **Page 7**

■ **Allied has obtained license to make biaxially oriented nylon-6 film for food packaging.** **Page 8**

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Calgene, striving to keep lead in plant biotechnology, expects to have major agriculture products ready soon. **Page 11**

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"The Financial Side of Industrial Research Management" by Lynn Ellis centers more on engineering R&D. **Page 49**

Cover: Workman prepares pigments for cosmetics such as lipstick. Photo courtesy of Avon Products

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LETTERS

Fighting with like weapons

SIR: Reference is to your article on the Pentagon need for binary chemical deterrent (March 18, page 13).

In what can only be considered typical Pentagon mentality, Thomas Welch "argued that the U.S. does not have a chemical weapon capability to deter the Soviets from using such weapons against U.S. forces or those of its allies." How incredibly asinine. By whose definition must wars be fought with like weapons? Can't we simply look at our arsenal on its own merit, decide if it is adequate to protect us, and then use whatever means necessary to respond to anyone who attacks us?

God help us if the Soviets ever aim a tiddlywink in our direction, for obviously the Pentagon will require a bigger and better one.

James Crawford, *Terre Haute, Ind.*

SIR: The argument that we must build more chemical weapons in order to ban such arms is mind-boggling. In the March 18 C&EN report of the Pentagon's request for more chemical weapons we have another example of how language and ideas can be twisted into virtual meaninglessness. George Orwell warned us of this.

It is my firm conviction we should continue the moratorium on chemical weapons production. I also believe it is possible to hold a rational debate over the differences between my position and that of the Pentagon. However, their current use of NEWSPEAK both dismays and puzzles me. I don't know whether to snicker or to cry.

Gerald Bakker, *Holland, Mich.*

The search for knowledge

SIR: Winslow Hartford has issued a call for independence of secular knowledge from sectarian "distortions" imposed on it by religious beliefs (C&EN, Feb. 11, page 2). This appeal misses the point entirely. The search for knowledge is driven by one ultimate goal—understanding the universe.

All knowledge, religious and so-called secular knowledge, is bound up in this same search. Assuming (as most religious people do) that there is a God who created the universe, the obvious question is whether an understanding of the nature and character of this God would provide knowledge which could be used in all areas of life.

Going further and assuming the truth of our assumption, were we able to speak directly with this God, could we find the answers to all the unanswered religious as well as scientific questions we now have? Therefore, for the majority of people who believe in a God (as Hartford states by assuming that only a few of us are truly atheists), there can be no separation of secular knowledge from religious knowledge, for they are one and the same. To separate the two in an artificial distinction is to already assume the two are different. To a religious man the distinction is a non sequitur.

What Hartford is really suggesting is that anyone can believe in God provided they do not claim that this God has anything to say about secular (translate human) knowledge. In other words, God doesn't care how the universe runs and neither should the "distorted" sectarians. The absurdity of this position should be clear to anyone, even someone so obviously anti-God as Hartford. And it is further heartening to see that politicians across the land are protecting us from such narrow-minded impositions upon our knowledge by "selfishly introducing these issues into their campaigns" and from such self-proclaimed experts who are "better equipped" to handle these issues than the people's representatives.

Joseph and Richard Luciana
Oakmont, Pa.

No political views in C&EN

SIR: I am shocked and saddened that you are allowing our publication to become a platform for government political views (C&EN, March 18, Editor's Page, "Advice to Scientists" by Secretary Shultz). Scientists are the conscience of the nation and are more concerned with human interest than a politician would be. Indeed, the core issues here are both political and moral. The morality of these vital issues, such as the imminent dangers of nuclear war to humanity, are more understood by scientists than by any political leader. If the scientists do not speak out, who will?

I doubt if the State Department allows any scientists' views to be published in any of its publications.

Rafi M. Salem, *Danville, Calif.*

Corrections

- April 8, page 17: In the table, the third column from the left lists quantities of leaded gasoline demand, rather than unleaded.
- April 22, page 75: There will be no on-site registration for the luncheons or banquet at the MARM meeting.

Cosmetics

Science is replacing art in formulations

Patricia L. Layman, C&EN London

In the world of cosmetics and toiletries, success rests on advertising, marketing, glamor, razzle-dazzle. For the world of raw materials for personal-care products, however, the emphasis is increasingly on science. What was once an art in making and formulating is becoming more and more sophisticated science. Raw-material suppliers that recognize that change and move with it will be the ones to ride to the top in the coming years.

Certainly the market is large enough to attract suppliers. Estimates are difficult to come by, but the 1985 market for raw materials for cosmetics and toiletries probably will be about 2 billion lb in the U.S. alone. That would be worth about $1.2 billion at the manufacturers' level.

All that for a U.S. market for cosmetics and toiletries that likely will ring up manufacturers' sales this year of more than $11 billion. The U.S. accounts for about one third of the total worldwide market for cosmetics and toiletries of more than $32 billion, according to one estimate; if the same proportions hold true, the worldwide market for raw materials for this industry is more than 5 billion lb of a variety of compounds, worth $3.4 billion.

Even though growth has slowed over the past few years and even though the cosmetics and toiletries industry has discovered that, contrary to conventional wisdom, it is not recession-resistant, it is still an industry well worth supplying.

Overall growth in demand is expected to be relatively slow, forecasts SRI International, in a new report on cosmetic chemicals, part of a specialty chemicals update program. Total growth of cosmetics and toiletries has averaged 1 to 2% per year for the past five years, considerably less than the

U.S. is largest western market for personal-care products

1983, $ millions at manufacturers' level

	U.S.	West Germany	France	Italy	U.K.
COSMETICS	$ 6,766	$ 962	$1002	$ 652	$ 431
Skin care	2,544	472	330	230	108
Fragrances	2,332	210	327	142	126
Makeup	1,270	200	187	163	125
Men's lines	640	100	166	147	72
TOILETRIES	3,814	1036	676	624	669
Hair care	1,590	475	352	236	275
Oral hygiene	954	227	115	115	112
Deodorants	740	140	65	107	76
Bath products	530	243	146	166	206
TOTAL	$10,600	$2067	$1680	$1306	$1100

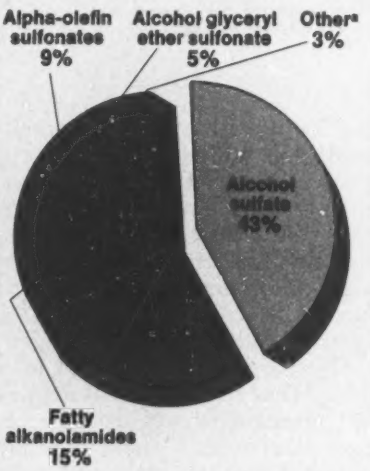
Sources: Industry, C&EN estimates

growth experienced during the 1970s.

More than 1000 chemical compounds are employed routinely as cosmetic ingredients, and many more are used less frequently or only in certain countries. Of all of these, cosmetic chemicals such as silicone emollients, sunscreen actives, and quaternized polymers used in hair conditioners are expected to maintain above average growth. However, ingredients such as dental polishing agents, which are formulated into end products already widely used, probably will grow at below average rates.

A steady stream of new products being developed by the cosmetics and toiletries industries likely will offer many opportunities for introducing new and improved chemicals, SRI says—although researchers in some supplier companies predict that because the volumes are relatively quite small, the chemicals won't have been developed exclusively for cosmetics and toiletries. Of particular interest are ingredients whose properties or origin can be used by cosmetic companies as the basis of new advertising or merchandising campaigns. And SRI predicts it is unlikely that there will be any dramatic or traumatic regulatory developments affecting the industry, such as the virtual elimination of chlorofluorocarbon aerosols in the U.S. in the 1970s.

Alcohol sulfate dominates cosmetics surfactants



1984 total = 169 million tons

a Includes alcohol ethoxylates, fatty amine oxides.
Source: C&EN estimates

The three largest markets for cosmetics materials—the U.S., Western Europe, and Japan—are considered highly mature, with slow growth. Higher growth is expected in Asian countries and in Latin America, provided economic stability is achieved in Latin America.

For the cosmetics and toiletries industry itself, there are an estimated 3000 manufacturers worldwide. However, 25 multinational manufacturers—giants such as Avon, L'Oreal, Procter & Gamble, Henkel, Unilever, Revlon, and Beecham—account for about half the business.

The raw materials side of the business is in striking contrast to that, however. One of the first surveys on this industry, by consultants Charles H. Kline & Co. in 1979, pointed out that more than 100 companies marketed cosmetic raw materials in the U.S., and no one company had a dominant position. The sales figures the study quoted then have changed, of course, but the structure itself hasn't changed all that much.

Perhaps most surprising, however, is that the most active suppliers to the industry are not the largest chemical companies. To be sure, they are frequently there, but generally with just one or two items they concentrate on. Union Carbide, for example, supplies its Polymer JR for conditioning products, and Du Pont and Phillips supply aerosol propellants. Far more important to the cosmetics industry are the smaller companies that concentrate on the entire industry, such as International Flavors & Fragrances, Croda, Onyx, Mona, GAF, Stepan Chemical, and Witco Chemical.

Even those subsidiaries of large companies that pay particular attention to the cosmetics and toiletries industry have tended to keep their identities as independent, smaller operations—ICI Americas, for example, to whom cosmetic raw materials are far more important than to its U.K. parent; Lonza, with a similar relation to its Swiss parent; Emery Chemicals, part of National Distillers & Chemical; Amerchol, part of CPC International.

Quite rare, in fact, are the companies for whom supplying the raw materials for cosmetics and toiletries is as important for both parent and subsidiary or division. Henkel in West Germany and in Minneapolis; Akzo in the Netherlands and in Chicago; BASF in West Germany and BASF Wyandotte in Parsippany, N.J., are examples.

Whoever is doing the supplying, however, the company is aiming at an industry with two distinct parts—commodity items and specialties. Fragrance compounds and surfactants account for roughly half the sales volume in dollars of cosmetic and toiletry raw materials. The rest of the market is then taken up with organic commodities such as ethanol and glycerin, and semicommodities such as sorbitol; organic specialties such as cellulose derivatives, sunscreen agents, and proteins; inorganic chemicals, including dentifrice polishing agents, nacreous pigments, and antiperspirant salts;

These are the primary groups of cosmetics' raw materials

Emollients
Esters—natural, synthetic
Ethers
Lanolin
Fatty alcohols
Hydrocarbons
Silicones
Various water-soluble emollients

Surfactants
Detergents, emulsifiers, solubilizers

Solvents
Ethanol

Thickeners
Modifying agents—for example, cellulose derivatives
Clays—natural, synthetic

Humectants
Moisturizing agents, conditioners, sterols, proteins

Preservatives

Perfumes/colors/flavors

Special-function active chemicals
Aluminum chlorhydrate, sunscreens

fatty chemicals, such as lanolin and its derivatives, and fatty acids and derivatives; biocides; and petroleum products, particularly mineral oil and petrolatum. Propellants are becoming increasingly important once again, as marketers see a resurgence in aerosol cosmetics and toiletries.

Those materials serve a variety of functions, from forming emulsions, thickening, and so on within the formulation, to a host of roles when the product is applied—giving emolliency, protecting, coloring, and the like.

Many of the materials used are of natural origin. That leaves them vulnerable to the vagaries of crop fluctuations, weather effects, and such—but it is also frequently a plus for marketers eager to cater to consumers smitten by the concept of "natural." Sometimes that's a matter of what you call it. Is labeling that proclaims "soy protein" unappealing? Perhaps "vegetable protein" or "phyto protein" would be more sales-evocative, as one supplier puts it. Silk protein, palm oil, chamomile extract—all are appealing terms for marketers to put on labels.

The opportunities for suppliers of natural-based raw materials for cosmetics and toiletries helped encourage the National Renderers Associa-

Typical applications of the major groups of cosmetics' raw materials

	Emollients	Surfactants	Solvents	Thickeners	Humectants	Preservatives	Perfumes/colors/flavors	Special-function active chemicals
Perfumes, colognes		●					●	
Dusting powder, talc	●							
Cream perfume	●			○	○			
Bath salts	●							
Bath oils	●	●					●	
Lipstick	●						●	
Lip salves	●							
Nail enamels	○		●				●	
Blushers	●	●		●		●	●	
Eye makeup	●	○	●	○		●	●	
Foundation	●	●		●		○	●	
Moisturizers, creams, lotions	●	●		○		●	●	
Astringents, tonics	●		●		●	○	●	
Treatment products	●	●		○		●	●	●
Sun preparations	●	●		○		●	●	●
Aftershave, colognes		●					●	
Preshaves	●							●
Talc	●						○	
Deodorants, antiperspirants	●	●		●			●	●

	Emollients	Surfactants	Solvents	Thickeners	Humectants	Preservatives	Perfumes/colors/flavors	Special-function active chemicals
Grooming creams	●	●					●	
Oils	●						●	
Hair tonics	●						●	
Hair sprays	●						●	
Setting lotions	●			○			●	
Hair colorants	○	●	●				●	
Bleaches	●	●					●	
Permanent waves	●	●						●
Conditioners		●					●	●
Shampoo		●					●	
Toothpaste		●		●	●		●	●
Mouthwashes		●					●	●
Denture products		●						●
Aerosol deodorants	●	●		●			●	●
Roll-on deodorants	●			●			●	●
Stick deodorants	●						●	●

● Used in product

○ Can be used in product

HLB values can predict performance. . .

Water solubility	HLB (hydrophile-lipophile balance) range
No dispersibility in water	1–4
Poor dispersion	3–6
Milky dispersion after agitation	6–8
Stable milky dispersion	8–10
Translucent to clear dispersion	10–13
Clear solution	13+

. . .for these kinds of applications

Application or use	Suggested HLB range
Antifoaming	
Alcohol systems	1–3
Aqueous solution or dispersion	1–8
Bath oils	
Spreading, mineral oil	9
Spreading, oleyl alcohol	11
Blooming, dispersible	5
Soluble	16–17
Blending immiscible oils	1–2
Clear gels (mineral oil)	10–12
Creams, ointments, and lotions	
Creams with acid salts	11–17
Creams, mineral oil-beeswax, oil in water	
Creams, petrolatum or mineral oil, oil in water	3–16
Creams, stearic acid, oil in water	9–15
Creams, fatty alcohol, oil in water	9–16
Creams and lotions, water in oil	3–6
Lotions, oil in water	6–18
Dyes	
Oil-soluble into water	12–18
Water-soluble into oil	3–6
Emulsions, oil in water	
Oils, mineral or petrolatum	7–12
Oils, vegetable	6–12
Wax, paraffin	9–12
Emulsions, water in oil	3–6
Petrolatum, washable	9–17
Solubilizing	
Flavor, vitamin oils	15
Essential oils, perfume	12–18

Source: ICI Americas

tion, of Des Plaines, Ill., to schedule an international symposium on natural-based cleaning agents and personal-care products in Marseille last week. Most of the symposium focused on the much larger soap and detergent industry. But at least some of the program pertained to cosmetics and toiletries, discussing such topics as historic backgrounds and economics, new raw materials and products, recent developments in analytical techniques, and new developments in processing and manufacturing. The symposium also featured a trip to Grasse, near Marseille, the traditional capitol of essential oils, so critical to cosmetics and toiletries.

At the same time as the emphasis on natural, the cosmetics and toiletries industry is taking on more of a scientific aura. That fact was highlighted in a recent survey on the shampoo and conditioner segment of the industry, put out early this year by Packaged Facts consulting firm in New York City, and it is also valid for most other segments. There is, says the company, "simultaneous infatuation of Americans for two divergent product trends: natural and technological."

Shampoos and conditioners provide a wealth of examples of the divergence. There are shampoos and conditioners with such ingredients as aloe vera, jojoba, and henna, and a number of new entrants with chamomile as a key ingredient, or marketing emphasis. On the other hand, there are both new and existing products in the segment positioned "scientifically," points out Packaged Facts, with the promotion stressing that technology will care for the hair.

Each is a valid approach for marketers, depending upon to whom they wish to sell, and market targeting is becoming increasingly more precise. However, it now costs about $6 million to introduce a new shampoo or conditioner, and 90% of the 200 or so new brands introduced each year fail on the marketplace. Marketers keep trying, however, lured on by hopes for several percentage points of a market now worth more than $2 billion at retail level. At present, about two thirds of those sales are shampoos and the rest conditioners, but the latter will see faster growth. By 1994, Packaged Facts predicts, the two segments will be nearly equal in retail volume.

In many respects, that is not surprising. Because whether the job is done naturally or scientifically, the consumer is seeking ever more conditioning, mild, and protective treatment from cosmetics and toiletries.

As one technical laboratory manager puts it, "Mildness is always a trend. It's not that the materials used now are irritating—they really aren't. But customers still want milder and milder products for their formulations." That has given a particular boost to amphoteric surfactants, the nonirritating surfactants used in baby shampoos. Mildness for children is one aspect of this, another is concern for frequent use. Mild surfactants, for example, won't scrub the hair squeaky clean if it is shampooed daily.

The search for mildness, and testing for nonirritancy of cosmetic raw materials, is one of the basic jobs for suppliers. The testing is relatively uncomplicated, and Draize eye tests probably cost about $1000 per chemical. (Gaining complete information for a safety data sheet might run twice that; if a product is going to be absorbed into the body—for example, from a wound dressing—that requires a new drug application, and costs range from $100,000 to $150,000.)

Testing also brings the industry up against one of its most implacable foes: animal rights activists, who protest the use of live rabbits in the Draize test. The pressure from these groups has encouraged much research into alternative test methods, but none are completely successful as yet. Revlon, for one, is now in its fifth year of supporting alternative safety tests with research at Rockefeller University in New York City, as well as doing its own, in-house testing.

Earlier this year, British researchers at Leicester Polytechnic developed a technique for using bovine corneas to assess chemical irritancy. The method monitors opacity as a measure of irritant-induced damage. Bovine eyes are obtained from slaughterhouses, and the corneas are clamped into an acrylic holder that allows solution to be in contact with both surfaces of the cornea. The holder is placed inside an opacitometer, in which a beam of white light passes through the cornea to a photocell. A decrease in the incident light reaching the photocell allows measurement of opacity caused by the test substances.

Testing costs for new materials do add up in the long run, and suppliers agree that that is especially true for raw materials that have never been used in cosmetics and toiletries before, or have no close analogs that might give some hint as to what kinds of safety testing are needed.

In fact, one supplier somewhat gloomily predicts that because of the testing costs, and the relatively small size and payout from the personal-care industry, very few new materials will be developed especially for it. New materials, he adds, will come from the pharmaceutical industry if any potential cosmetics applications come to light.

That is not a new development. Two years ago, for example, consultants Frost & Sullivan pointed out the ramifications of that in a study on the European cosmetics and toiletries industry. "As the distinction between cosmetics and drugs blurs, research-based organizations that approach cosmetics and toiletries almost as over-the-counter drugs will prosper during the 1980s," the company said. On that basis, the study predicted that by 1990, companies such as Beecham, Richardson-Vicks, and Elida-Gibbs would be the major marketers in Western Europe of personal-care products.

Hair-care products account for largest share of western market for toiletries

If that held in the U.S., it would give even more impetus to cosmetics houses, such as Revlon, that have a pharmaceutical arm, with the scientific side of pharmaceuticals becoming more important in R&D.

Until that development really takes hold, however, U.S. marketers of cosmetics and toiletries will go their merry way with product innovation and promotion. Industry observers agree that the U.S. market tends to react faster to new trends in the cosmetics and toiletries industry, and that when it does not actually introduce new products and concepts first, it frequently can carry the ball further.

A number of years ago, for example, an ordinary toilet soap called "Fa" appeared on the West German market, with a—for the times—high concentration of fresh, outdoors scent. American marketers liked the idea, came home and set about formulating their own highly scented soaps. That led to a proliferation of highly scented, decorative, and expensive soaps, the sort now found in fancy boutiques, department stores, and gift shops.

The same thing may be happening now with the latest star in the cosmetics and toiletries world—mousses. The premier definition of the French word "mousse" is "froth, foam; lather; whipped cream." Foam technology has been around for decades—aerosol shaving lathers have been the pre-eminent examples. (This oldest of "mousse" uses got a major boost in 1983 when several brands of gel lather were introduced to compete with S. C. Johnson's Edge.) And at one time, there were some small, and ultimately unsuccessful, attempts to use foam technology for other kinds of personal-care products.

But several years ago, European marketers, led by L'Oreal, introduced mousse hair-care products, and the concept took off. There are a number of advantages to the mousses. They aren't messy (important for a consumer coloring his or her hair, for example), and they give pinpoint application precision (no overspray or runny liquids). Given the high proportion of air incorporated into them, the products are extremely light and fluffy.

The hair-care mousses also provide a functionally excellent combination of hold, with a setting resin, and combability, with a conditioning resin. It was new to the younger generation of consumers, who perhaps had never seen other, earlier attempts at foam products, and off it went.

In the U.S., moreover, when the mousses were introduced, they had the cachet of European (especially French) marketing, and they took off here, too. In fact, the market may be expanding in the U.S. even more rapidly than in Europe.

Some suppliers feel that the European market is being stifled because L'Oreal has such extensive patent coverage (the basic one, by one report, 100 pages long, and at least three more, covering variations and extensions of the technology) on use of combinations of cationic and anionic resins in foams.

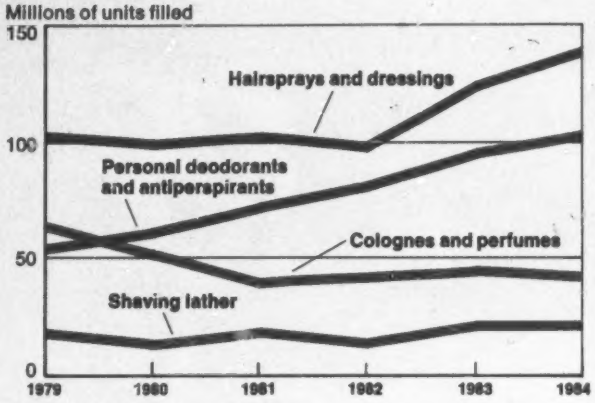
"Cosmetics aren't normally too long-lived—certainly much less than a 17-year patent life," says one supplier. L'Oreal's patents have given it a jump on its competitors, but also have hindered development of the technology because it is stretched to meet its hair-care product requirements.

It is too early, some suppliers say, to predict interest in Europe for mousses for other kinds of products, including skin-care items, body lotions, suntan preparations, baby products, and so on. But in North America, new mousse products already have been introduced in test markets, with Canadian consumers having a number on the regular market. For instance, at least one marketer has introduced in Canada a product that suppliers believe is promising: a baby powder. It is sprayed as a foam on baby's bottom, where it dries to a powder. There is no powder in the air to cause coughing or sneezing, and no mess.

Meanwhile, suppliers are watching to see when mousses will find success in the Japanese market, where up until now they have been absent.

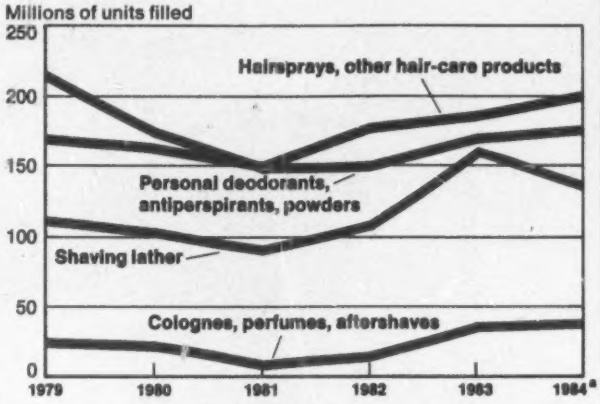
Suppliers wind up in a debate as to

Hair mousses have boosted U.K. aerosol sales . . .



Source: British Aerosol Manufacturers' Association

. . . and may help U.S. personal-care aerosol market

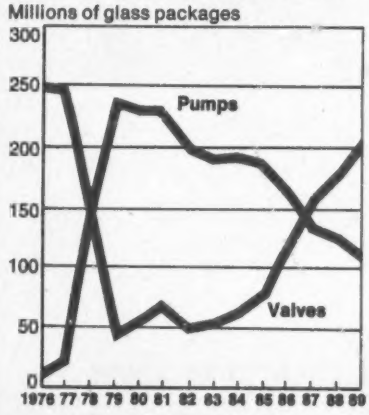


a C&EN estimate. Source: Chemical Specialties Manufacturers' Association

whether mousses are a lasting phenomenon or a passing fad. Most, however, feel that products, not the packaging, tend to be a fad, and the mousse technology is really a method of packaging and delivery. The benefits are there, they believe, and this time around, foams will be here to stay, by whatever name.

That's good news for the aerosol industry, which already has been the prime beneficiary of the mousse movement sweeping the cosmetics and toiletries industry—much to the bemusement of industry marketers. After all, mousses are simply foams, and foam technology has been around for decades. Not long ago aerosol cosmetics and toiletries were having rough times. But it looks increasingly as though the upturn that began haltingly in 1982 gained strength in 1983 and into last year, becoming a genuine growth phase. For suppliers to this industry, it can only be a matter of "It's about time."

Valves may exceed pumps in U.S. fragrance aerosols



Note: Includes imports. Source: Risdon Mfg. Co.

A leading indicator of the renewed health of cosmetic and toiletry aerosols comes from the U.K. In 1983, aerosol production there hit record levels. And last week, the British Aerosol Manufacturers' Association released its 1984 report, which showed yet another record year for production. The major reason for the growth? The 12.4% increase in the category "hairsprays and dressings," which rose from 124.5 million units filled in 1983 to 140 million, to account for 22% of the total British aerosol market.

Other than the Scandinavian countries, however, Britain and the rest of Europe saw relatively little effect on their aerosol markets because of the controversy surrounding chlorofluorocarbon propellants. The controversy hit the U.S. hard, though, when it developed in 1973.

For U.S. aerosol marketers and suppliers, the term is still "recovery." The industry is back to growing, but it hasn't returned to the dizzy levels of 1973, when 2.9 billion aerosol units were filled. From those levels, production gradually tumbled, reaching a low of 2.16 billion units filled in 1980. Of those, 29% were personal products, and that category had slipped 17% from 1979 alone. In 1983, in the U.S., 2.28 billion aerosols were filled; of those, 33% were personal products. Production figures for 1984 won't be reported until next month by the Chemical Specialties Manufacturers' Association, but overall growth is expected to be about 5% from 1983. And much of that growth, as in Britain, will be coming from personal-care products in aerosols.

The CSMA "personal products" category includes a variety of subsegments, including medicinals and pharmaceuticals (for example, vaporizers, burn treatments, and antiseptics) and "other" (such as suntan preps and depilatories). But the bulk of the category consists of hairsprays and other hair products; shaving lather; personal deodorants, antiperspirants, powders and deodorant colognes; and colognes, perfumes, and after-shave. Industry observers expect the 1984 figures to show growth for all these segments except for shaving lather.

It all seems to indicate, then, that the industry finally has begun to emerge from the shadows cast over it by the debate and controversy begun in the early 1970s over whether chlorofluorocarbon propellants could damage Earth's ozone layer. Banning the use of chlorofluorocarbon propellants resulted in a switchover to other aerosol propellants, primarily hydrocarbons.

And further changes in propellant systems also may mean new opportunities for aerosols. For example,

Ozone scare sent aerosol sales plummeting

When the controversy about chlorofluorocarbons and possible depletion of Earth's ozone layer arose early in the 1970s, it was seized upon by what one industry marketer calls "the new Calvinists, who were already pillorying aerosols as the symbol of the hedonistic, luxury-loving generation." With that campaign joining the scientific debate on atmospheric chemistry, the damage to the aerosol industry was perhaps inevitable.

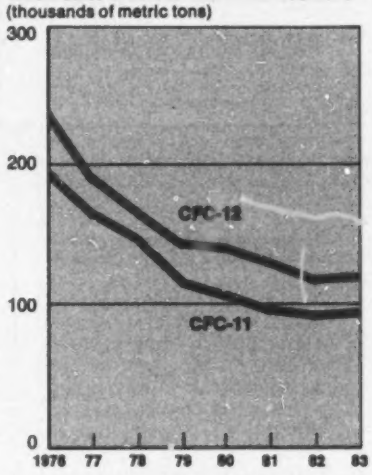
In the U.S., the Environmental Protection Agency banned use of chlorofluorocarbon propellants, with only a very few exceptions. The Scandinavian countries (particularly Sweden and Norway) were similarly restrictive. The Danish representatives in the European Economic Community lobbied for severe restrictions on the use of chlorofluorocarbons, echoed by none-too-subtle pressure on European scientific and business communities by U.S. representatives.

"We were somewhat jaundiced by the pressure from the U.S.," says one European marketer. "It was very counterproductive. The U.S. environmentalists kept saying, 'We've got to be right, and you have to do this.' We resented that."

The EEC camps that wanted a ban on chlorofluorocarbons and those believing more research should be done first eventually compromised on a 30% reduction from the 1976 level of production of the two major aerosol propellants. That reduction, and an agreement never to expand capacity in the future, affected the bulk of chlorofluorocarbons in Western Europe, which went mostly into aerosols, unlike in the U.S., where air conditioning is also an important, and unrestricted, end use for the two chemicals involved—CFC-11, trichlorofluoromethane; and CFC-12, dichlorodifluoromethane. The result has been a decline of more than 50% in sales of the two compounds used for aerosols worldwide, according to the running data collected by the Fluorocarbon Program Panel of the Chemical Manufacturers' Association.

Meanwhile, hydrocarbon propellants, which had been gaining steadily in importance for aerosols in the U.S., became nearly all the market. That changeover was most significant for personal-care products, as hydrocarbons were already the most widely used propellants for such aerosol categories as household products and paints.

Global sales of aerosol chlorofluorocarbons (thousands of metric tons)



Source: Chemical Manufacturers Association

More ominous for the aerosol industry during that troubled decade, however, was that many marketers abandoned aerosols. They either dropped them out of their personal-care product lines altogether, or they relegated them to stepchild status, giving them no advertising support.

Very few marketers of cosmetics and toiletries attempted to explain in advertising that there had been a change of propellant to one not involved in any controversy. Indeed, on the few occasions when they did try to explain, there was controversy within the aerosol industry itself, where some people felt the industry should stand together—or fall together.

Although the debate is now more than a decade old, and it still has not been settled much to anyone's satisfaction, things are beginning to settle down. As one U.S. supplier notes, "For 10 years, the industry spent its time and money fighting regulations, coping with costs for switching over propellants, fighting warehousing battles, and so on, not spending them in labs for R&D or on advertising promotions. All those problems are in hand or mostly in hand now. And now marketers are beginning to advertise aerosols again. R&D labs are beginning to work on new concepts again. So the growth that will come will be from increased use of aerosols and from new products."

fragrances have proved the weakest market area for hydrocarbon propellants, with most marketers electing, instead, to use pump packages. Pumps aren't all that satisfactory, however. They are more expensive than aerosol packaging; they don't give a fine, continuous spray; and they introduce oxygen into the fragrance upon each use, which can degrade the fragrance oils.

The commercialization of new propellant systems—dimethyl ether, for example, or hydrochlorofluorocarbons (unrestricted because they are not perfluorinated) such as chlorodifluoromethane, 1,1-difluoroethane, and 1,1,1-chlorodifluoroethane—may change this. U.S. industry observers say these new propellants are particularly interesting to European fragrance marketers eager to bring to the U.S. the same perfumes and colognes they sell in other areas of the world, without having to reformulate to cope with different propellants.

The possibilities for the new propellants have led to predictions by valve maker Risdon Manufacturing Co. that by 1986, the fragrance industry, which shifted from aerosols to pumps in 1977, will shift back. U.S. fragrance houses also will be important to this move, of course, and suppliers are keeping an eye on new product introductions. There were high hopes late last year for the launch of a new Estée Lauder aerosol perfume, for example, and keen disappointment at its lack of major success. Chagrined suppliers say, however, that the experience was due to an uncharacteristic fumbling on Estée Lauder's part in dealing with the department store personnel who sell the fragrances, rather than product performance per se.

It will remain in established categories, though, that aerosols will continue their recovery; suppliers

Eye makeup (above) uses emollients, solvents, preservatives, and colors, whereas lipstick uses emollients, colors, scents, and flavors

reckon that if the industry could once sell 2.9 billion units in a year, it can again, and more. One cites the case of personal deodorants and antiperspirants. When aerosol products were first introduced, they took over within about four years. "The beneficial properties that won for aerosols in the first place—convenience, hygiene, economy—are being recognized again," he says. Other competing types of packaging, adopted during the past decade, will never be abandoned, because they have been improved over the years, too.

But new aerosols are coming out for both new and established product categories. As one supplier puts it, marketers can "put back money into the business of making money."

Some U.S. marketers of cosmetic products soon will have a positive encouragement to commit themselves to aerosols, especially mousses: the supply of the containers themselves. Most of the present production of the aluminum containers has come from one company, Boxal, an Alusuisse subsidiary, and it has had severe problems keeping up with demand. New technology is being built in the U.S. and Canada, however, and other capacity is being expanded there. The result? A great deal of overcapacity, predicts one aerosol-industry observer.

Except for some of the more basic commodity chemicals used by the industry, cosmetics and toiletries aren't usually much affected by oversupply problems. But in an industry that uses relatively small quantities, an adequate or snug capacity through the industry can move quickly into the realm of overcapacity, when a number of different firms spot the same opportunity and decide to jump in.

There is the danger, for example, that that is happening now with sunscreen agents—chemicals incorporated into formulations to protect the formulations themselves from in-container degradation, and to protect consumers from exposure to ultraviolet light.

Historically this tended to be a rather staid business, with suppliers providing material for product protection (used at about 0.1% in the formulation) and material for the classical suntan products (generally 3 to 5%). But that has changed. Dermatologists who used to be regarded as wet blankets and cranks, warning about the dangers of excessive sunbathing, began to be listened to seriously. And in one of the few pieces of regulation welcomed positively by an industry, the Food & Drug Administration decided that manufacturers who incorporated sunscreens into their products could, under appropriate conditions, be allowed to say on product labels, "May help prevent premature aging and wrinkling of skin, and skin cancer, due to sun overexposure." That can't help but be an appealing marketing claim. Different levels of skin-protection formulations came out, from the lowest which encourages sunning on already tanned or dark skins, to sun blocks for extremely fair skin. Concentrations now run from about 3% ultraviolet absorber to as much as 10% of a formulation.

Moreover, cosmetics and toiletries makers began incorporating sunscreen agents into other products—into lip balms, for example, or skin-care lotions and foundations, and even into some hair-care products.

That has broadened the market for sunscreen actives considerably and lured companies in. BASF Wyandotte, for example, bought GAF's ultraviolet inhibitors (much of which goes into sunscreens) business in 1978 and has been marketing its products aggressively. ICI Americas decided to get into the sunscreen actives business, to complement its other product lines for the cosmetics and toiletries industry. Emery Chemicals is not yet in the business, but is at least considering it, for the same reason, to complement its lines.

How long the market will continue to boom, however, remains to be seen. At least one supplier predicts that the market has reached a peak in the growth rate—that the market will continue to grow, but not by the

leaps and bounds of the past five years. "Most major companies are in it," he says, "so unless there are new innovations, new products will only take market from somebody else. Even smaller companies are trying to copy products"—the market, he implies, is filling up.

As it happens, for suppliers to the cosmetics and toiletries industry, most material categories are probably adequately supplied. Business for suppliers is, of course, dependent upon how business is for their major customers—what is happening with Revlon, or Helene Curtis, for example, or Procter & Gamble, and so on, and how frequently the majors decide to launch new products.

"Our business rises and falls with these people," says one supplier. "Because the industry really is fairly mature, growing in proportion to [gross national product], our business comes with new product introductions. When one of the majors launches a new product, the pipeline fills. There are big surges if your materials are in that product. The new products may give one positive year, then be down the next, though." And in subsequent years, when the product pipelines into the distribution chain have long ago been filled, then business for any newcomer will be only a fraction of that that benefited the first supplier.

It also may depend upon what a supplier is selling. Marketers of specialty raw materials, for example, feel a slightly smug sorrow for those who peddle the commodity items. "You read off the specs and spend the next hour or two haggling on the price," explains one. "It is much easier selling specialties, where you can convince a customer that your material is precisely the one he [or she] needs."

Selling to major customers, in particular, can be fraught with difficulties for suppliers. In the first place, the supplier's major selling point—technical service and backup—is not needed by companies that know much more than suppliers could.

"Basically, the big companies really know your business, and they practically can tell you what you should be charging," laments one supplier. "They want to know how you make the product, what your raw materials are, and so on; they can figure out what your costs are. They know what's happening, for example, to raw material costs for us. People are very astute about this."

For those companies, selling is often responding to bids, and for a half-cent a pound, the company will switch suppliers. "That has taken some of the fun out of selling," says one.

What suppliers find far more satisfying, however, is working with smaller, entrepreneurial companies to develop new cosmetic and toiletry products. To sell to smaller companies, suppliers must get their product approved through a lengthy but rewarding path: by knowing the chemists in the lab and in the development side. The trick is to get a product into the formulation, suppliers agree, as it is being developed. Then once it is in, if the company decides to launch the product, the company gets that pipeline business. Everyone else is after the fact and must fight against the success of the product to become an approved alternative supplier.

The challenge to the technical department and the formulator, of course, is to come up with new concepts to suggest to marketing, and to meet the demands for concepts marketing has already come up with—whether one is a supplier company or the cosmetics and toiletries maker. (It only seems as though marketing wants only what the lab doesn't have.)

For the smaller cosmetics and toiletries makers, suppliers fill a crucial role. In fact, one says bluntly, "customers depend on suppliers for innovation." There is still an industry predominance of small- to medium-sized suppliers, but the pressure is on these companies to come up with innovations from their chemicals, to have the wherewithal to do the necessary testing—for instance, shelf life, stability, compatibility testing—required to support the new material being suggested for the innovation.

Serving the industry has always been the key, and it is increasingly important. "You have to have an identity," says one supplier, "with sales and technical service to support that." Personal relationships with cosmetics chemists and other executives at the small cosmetics companies are extremely important, as is the ability and willingness to cater to the needs of the small customer. This is perhaps one reason why large companies shy away from the cosmetics and toiletries industry. Most large, commodity chemical companies wouldn't entertain for a minute the thought of making just 1 million lb of some particular chemical for the industry. Many of the suppliers devoted to the business, however, consider as a "major" customer order anything above 1000 lb.

Combine that willingness with good technical service and applications work, and suppliers can build up a surprisingly loyal relationship with their customers. Cosmetics and toiletries companies are still keenly aware of prices, of course, but they will consider switching only among

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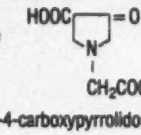
Find out how to make 

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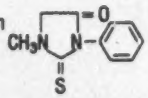
or how to form 

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Chromatography boosts the business

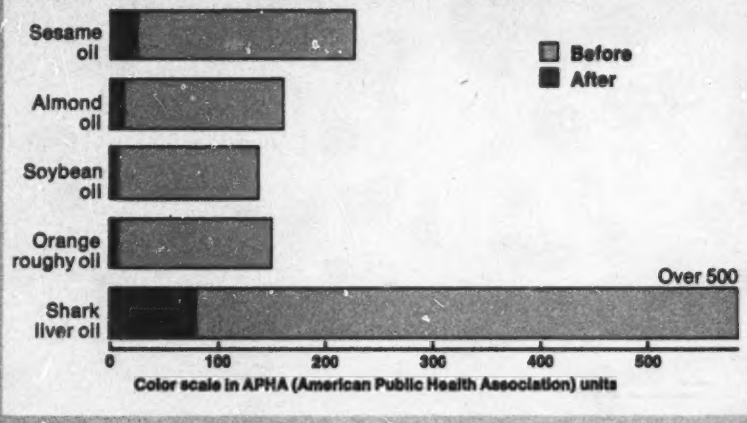
For cosmetic raw materials, chromatography is steadily increasing its importance as both an analytical and a processing technique.

Du Pont, for example, is actively promoting its high-performance liquid chromatography system for quality control and analysis of fragrance materials. Customers such as Création et Diffusion Internationale de la Parfumerie, which makes Roger & Gallet toilet soaps and various skin-care and bath products, use the system for analyzing fragrance compounds, in particular. The chromatography is especially gentle on fragrances, which tend to have easily degraded constituents.

On the other hand, chromatography is a key processing tool for Croda, which has developed a commercial-scale process for purifying and refining natural oil. It has dubbed the process "flash chromatography," and says it is more suited for natural-oil refining than other methods, such as bleaching (which introduces problems of sensitivity and oxidative stability), deodorization either by steam or activated-earth treatment (little improvement in color), washing, and molecular distillation (energy-intensive and unsuited for higher-molecular-weight products such as higher alkyl esters of wool-wax fatty acids).

Most of the details of the process are proprietary; Croda says only that it is a commercially workable scaleup of fine laboratory chromatography, using proprietary adsorbents and "a novel regeneration method." The products tend to be higher priced than those not refined by the process, Croda marketers concede, but they argue that the technique is opening new applications for lanolin derivatives, emollient esters, and natural oils that are otherwise too dark in color or too high in odor characteristics.

Croda uses chromatography to purify natural oils



a certain range of suppliers they have worked with over the years. Similarly, many of the top applications and technical service pesonnel at supplier companies come from the labs of cosmetics and toiletries houses.

Applications work has been the basis of the industry over the years, and it still is. But there are some shifts occurring. Cosmetic chemists have always had an aura of art about them, and to some extent, that, too, continues—the science must be there in the first place, of course, but in many cases, it comes down to the artistry of putting together a well-functioning, esthetically pleasing product. Notes one supplier, "You only have to go to Eastern Europe and get cosmetics and toiletries there to see the difference esthetics make."

But more and more, researchers within the cosmetics and toiletries industry, and in raw-material supplying companies, are tackling some more fundamental topics, looking not just at the "hows" of products but at the "whys."

They are looking seriously into the chemistry of skin and hair, for example, finding out what happens if this or that material changes in substantivity, or what happens if a more penetrating product is used. Marketing claims usually are based on very low concentrations of specialty ingredients. What happens if more therapeutic concentrations are incorporated into a formulation? At what point does a product become not just pleasing and esthetic, but actually functional and efficacious? At what point could the activity of vitamins, for instance, be harnessed in an efficacious and healing cosmetic lotion? What effect do proteins have?

Questions like these are taking the industry ever closer to the pharmaceutical industry. It's probably inevitable, for one thing, given the increasingly stringent regulations affecting the cosmetics and toiletries industry from safety to labeling. It is also probably inevitable as cosmetics and toiletries become an ever-more important part of life. There have been extraordinary changes, over the past 30 or 40 years, in how cosmetics and toiletries are regarded, from rather outré products, luxuries at best, to necessities. They don't just hide deficiencies, they emphasize positive attributes.

Those attributes can be cosmetic only, but they also can be biological and physiological, suppliers say. Research into how older skin can be regenerated, for example, will be the basis for personal-care products for the increasingly large senior citizen population. Research into how products react differently on different kinds of skins will give even more scientific soundness to products developed for ethnic markets.

The challenge for the cosmetics and toiletries marketers will be not just to put things together to sell, but to understand what is happening and how to control how the product is reacting on, for example, skin or hair. As one supplier notes, "There is a gray area between pharmaceutical over-the-counter products and cosmetics that is growing faster than the other segments. We have to walk the borderline, and that is quite a difficult path." □